

WHAT IS CLAIMED IS:

1. A ballistic material comprising a stack of woven layers, and at least one nonwoven layer on a face of said stack of woven layers, said nonwoven layer attached to and entangled with the stack of woven layers by needlepunching to form an integral material having an areal weight of about 0.07 pounds per square foot ( $342 \text{ g/m}^2$ ) to about 10 pounds per square foot ( $48.8 \text{ kg/m}^2$ ).
2. The ballistic material of claim 1, comprising a non woven layer on each face of said stack of woven layers.
3. The ballistic material of claim 1, wherein the stack of woven layers comprises 4 to 20 quasi-unidirectional aramid fiber fabric layers cross laid at right angles.
4. The ballistic material of claim 1, wherein the nonwoven layer consists essentially of fibers having a tenacity of at least about 15 grams per denier ( $13.5 \text{ g/decitex}$ ) and a tensile modulus of at least about 400 grams per denier ( $360 \text{ g/decitex}$ ).
5. The ballistic material of claim 1, having a backface signature of less than 44 mm at a material areal density of 0.5 pounds per square foot ( $2.44 \text{ kg/m}^2$ ).
6. The ballistic material of claim 1, calendered to a thickness of about 0.1 inches ( $0.254 \text{ cm}$ ) to about 0.3 inches ( $0.76 \text{ cm}$ ) having an areal density of 0.18 pounds per square foot ( $878 \text{ g/m}^2$ ) to about 0.60 pounds per square foot ( $2.928 \text{ kg/m}^2$ ).
7. A ballistic material comprising at least one woven layer of ballistic grade fiber and at least one nonwoven fiber layer, said nonwoven layer entangled

with the woven or unidirectional layer in a direction substantially perpendicular to an x-y plane of the ballistic material.

8. The material of claim 7, wherein said nonwoven layer is entangled with the woven layer by needlepunching.

9. The material of claim 7, wherein said woven layer comprises unidirectional or quasi-unidirectional ballistic grade fibers.

10. The material of claim 7, wherein said at least one nonwoven layer comprises ballistic grade fibers.

11. The material of claim 7, wherein said at least one nonwoven layer comprises staple para-aramid fibers.

12. The material of claim 7, comprising a plurality of layers of unidirectional tows of ballistic grade fibers cross-laid at 90 degree angles.

13. The material of claim 7, comprising a plurality of layers of woven ballistic grade fabric.

14. The material of claim 7, comprising a plurality of layers of knitted ballistic grade fabric.

15. The material of claim 7, comprising a plurality of layers of stitched tows of ballistic grade fibers.

16. The material of claim 7, further comprising a water repellent coating.

17. The material of claim 7, having a thickness reduced by calendering.

18. A method of making a ballistic material comprising the steps of:  
superposing at least one nonwoven fiber layer on a ballistic grade  
woven or unidirectional fiber layer to form a stack, and  
subjecting the stack to mechanical entanglement of the fibers of the  
nonwoven layer.

19. The method of claim 18, wherein said nonwoven layer is entangled  
with the woven layer by needlepunching.

20. The method of claim 18, wherein the stack comprises 4 to 500  
layers of unidirectional, quasi-unidirectional, knit, or stitched tow layers.

21. The method of claim 18, wherein the stack comprises 4 to 20 layers  
of unidirectional or quasi-unidirectional aramid fiber fabric cross-laid at ninety  
degree angles.

22. The method of claim 21, wherein the stack comprises nonwoven  
layers superposed and entangled on opposite sides of said 4 to 20 layers of  
unidirectional or quasi-unidirectional aramid fiber fabric.

23. The method of claim 16, further comprising a step of calendering  
the material after needle felting to increase the density.

24. The method of claim 19, wherein the material is calendered to a  
density of about 0.07 pounds per square foot (342 g/m<sup>2</sup>) to about 0.80 pounds per  
square foot (3.906 kg/m<sup>2</sup>) and a thickness of about 0.1 inches (0.254 cm) to about  
0.3 inches (0.76 cm).

25. The method of claim 16, further comprising a step of applying a  
water-repellant coating on the material.

26. The method of claim 16, comprising the step of interleaving nonwoven layers between layers of woven or unidirectional fabric prior to needle felting.

27. The method of claim 16, comprising the steps of needlepunching a first stack having a plurality of woven layers and a nonwoven layer on a face thereof, and needlepunching a second stack having a plurality of woven layers and a nonwoven layer on a face thereof, and needle punching the first stack and the second stack together so that the nonwoven layers face opposite sides of the material.

28. The method of claim 16, further comprising the step of testing the ballistic material after manufacture for a backface signature of less than 44 mm, such that the material is ready-to-use in the manufacture of ballistic articles.